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# Handwriting Vocal Character Pattern Recognition: Implementation of Artificial Neural Network Algorithm for Electronic Medical Record

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**Abstract.** Medical Record (MR) necessary to determine right treatment to patient. It contained medical history of patient and made communication of health team easier. Data written in MR must be clear and presentable. The objective of the research was establishing a system that recognize vocal character patterns and translate it into text. This is a preliminary research of advanced electronic medical record which allowed the doctors or the other health team in recording, saving and processing the data of medical records through the natural gestures. The input system is "A, I, U, E, O" character in handwriting that was written on tablet pen, then it was directly brought up to preprocessing stage. Then, the introduction was done through the backpropagation of artificial neural network algorithm which had 625 inputs, 2 hidden layers and 5 outputs. The data of 'A', 'I', 'U', 'E', and 'O' in vocal learning in which each character consisted of 5 samples. The success of A, I, U,E,O introduction system was as much as 100%, 80%, 66%, 80%, 80%. The experimental result show validity of the proposed method.

## 1. Introduction

Medical record consists of files or documents about the patient's medical history covering the patient's identity, the examination results, treatment, as well as the actions and services given to the patient [1]. Every patient has any documents of medical record which is generally in handwriting on paper and stored in wooden shelf or roll pack filling room. Doctor is a part of broad multidisciplinary care teams. The record written by doctor in a rush will impact the communication occurred between the other workers. In 2005, three surgeons audited the readability of 40 random surgery records from orthopedic ward in a Large Hospital located in England and its result showed that 37% of handwritings were considered bad. For the workers of healthcare team, outlining the notes written by doctors can be a distraction as it sometimes requires help from the other health workers. According to the patient's perspective, the unreadable handwriting is able to delay the treatment and cause unnecessary test and improper test which can be turned into discomfort or even death [2]. The technology of computerized patient data or an electronic medical record (RME) is needed to overcome this problem. Several researches were conducted especially on the design of user data and patient care data [3], web-based medical record[4] etc. RME should be developed into the one with artificial intelligent, not only capable in storing the data of patients in large amount [5].

This research is an initial research that implemented artificial intelligence to support electronic medical records, in recognizing the doctor's handwriting and translating it into written text. Thus, the doctors would be easier in taking notes on medical record data as they still depend on their handwriting that is commonly used but it can still be stored in the database. The data processing was even easier because it could be processed automatically through a computer.

## 2. Literature Review

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### *2.1 Electronic Medical Record*

Electronic Medical Record is a legal record made in hospital and any health centers whose data are the sources of (Electronic Health Record). EHR is a medium to share medical information between stakeholders and patients who have had any treatments. The stakeholders are the patients, health service providers, entrepreneurs and/or insurance payer, as well the government.

### *2.2 Artificial Neural Network*

Artificial neural network is a large number of processors that are distributed in parallel and consist of simple processing units, where each unit can store the experienced knowledge and can reuse it [6]. Neural network consists of several neurons that are interconnected as in human brain. Neuron is an information processing unit which is the basis for neural network operation. A neural network needs to be trained first before being used to solve problems. The training results produce the correct (desired) response to the input provided. The neural network can provide the correct response even though the input given is affected by noise or changes by a situation [7]. The neural network consists of several non-linear counting elements, each of which is connected through a weight and arranged in parallel. This weighting will later change (adapt) during the training process..

## 3 Method

The artificial intelligence used in this research was artificial neural network (ANN) with the type of backpropagation which the working principle is shown in Figure 1. The user writes 5 types of characters "A", "I", "U", "E", and "O" alternately using pen tablets in the can vas image application that has been built. The writing results become grayscale image in .bmp format with a size of 100x100 pixels. Then enter the Preprocessing stage, which is to change the grayscale image to a binary image and do a compression technique using Discrete Wavelet Transform (DWT) [8]. The image was compressed 2 times so it became 25x25 pixels. So, the input data was 625 as the input layer. In binary image, white was 255 and black is 0, then divided by 255. So, the input data was 1 and 0.
Each alphabet had different output target values as shown in table 1. Hidden layer 1 and hidden layer 2 each valued 630 and 100.

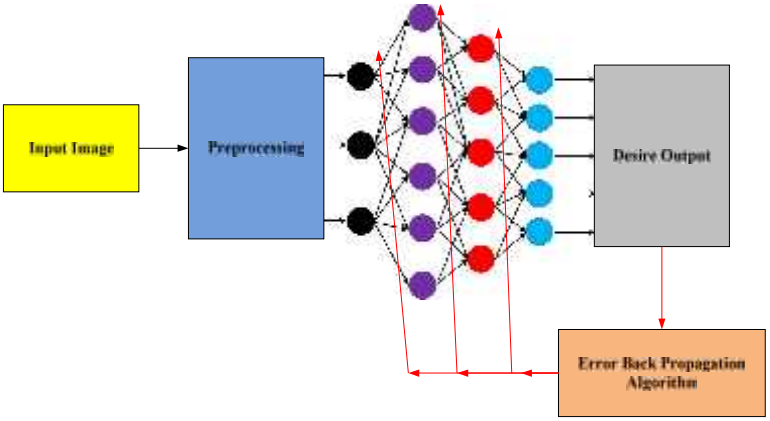


**Figure 1.** Block diagram of Backpropagation Algorithm working

principle.

**Table 1.** The determination of output target.

| Character | Output Target |
|---|---|
| A | 0 0 0 0 1 |
| I | 0 0 0 1 0 |
| U | 0 0 1 0 0 |
| E | 0 1 0 0 0 |
| O | 1 0 0 0 0 |

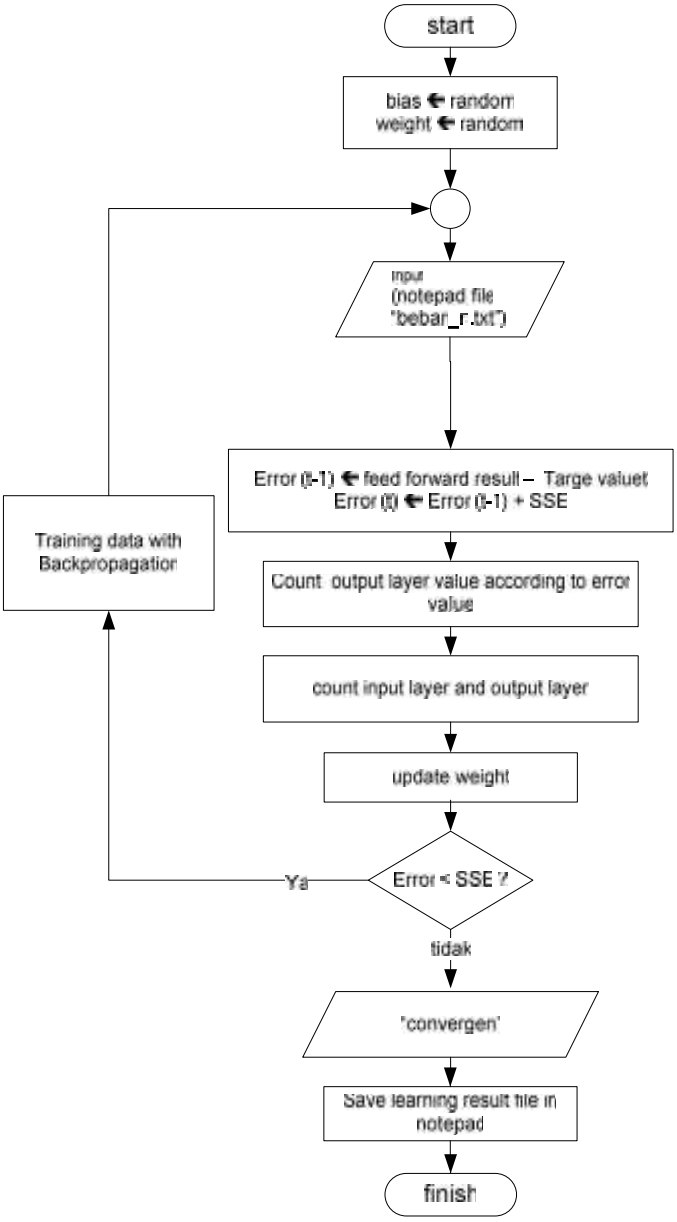

**Figure 2.** Flowchart of the Artificial Neural Network Learning Process

The next process was explained gradually as shown in Figure 2. The bias and the weight values were determined randomly as the initial value. Then took the first sample learning data from notepad which had the file name "beban_n.txt" and was placed on the feed forward process input variable with variations in input, weight, and bias so that the output values of each layer were obtained. Output results are calculated using the sigmoid binary activation function [9] as shown in equation 1.

$$f(x) = \frac{1}{1+e^{-\alpha x}} \quad (1)$$

Where $\alpha$ is constant, $x$ is output layer value and $f(x)$ is activation function result. Then, calculate the error by finding the difference between the output result of feed forward process and the output target. Next, calculate the values in the layers to produce the new weight value. By using Backpropagation Algorithm, the learning process is done until the error value is less than the SSE (Sum Square Error) value. Therefore, the optimal weight value is generated and save the file in the notepad. The weight value is used as a success test parameter of Artificial Neural Network Algorithm design.

## 4 Experimental Result

The flowchart of the Artificial Neural Network Learning Process was implemented in the form of software by using pascal language. User wrote the vocal characters ‘A’, ‘I’, ‘U’, ‘E’, ‘O’ on the canvas for 5 samples for each character. So that there were 25 learning data. Then, the learning process was done until reached convergence. The table 2 showed the success level of each character. The test was done by writing 5 samples for each character, and seen whether or not in the 5 samples could be identified well.

The character A was recognized for 100%. However, in the U character test was only 66%. This means, in the 5 times writing, there were 2 times recognition mistakes in the character U. In the figure 3(a) the character U was recognized, in the figure 3(b) the character was not recognized, it was indicated by the output values as much as ‘0 0 0 0 0’, and in the figure 3(c) showed the recognized U character as another character.

Next, re-test was conducted by taking 10 samples for each character so that there was 50 learning data. Therefore, the iteration time was 12754, this total was much more in comparison to the previous test that was only 11996 iteration. The result of the test was shown in table 3. ‘A’ character success level reached 100% and the other character test was 80%. Therefore, if the percentage total was counted, it was 84%. This percentage value was higher compared to the table 1 which used 5 samples for each character

**Table 2.** testing result of 5 samples for each character

| Character | Result (%) |
|---|---|
| A | 100 |
| I | 80 |
| U | 66 |
| E | 80 |
| 0 | 80 |
| Average | 81.2 |

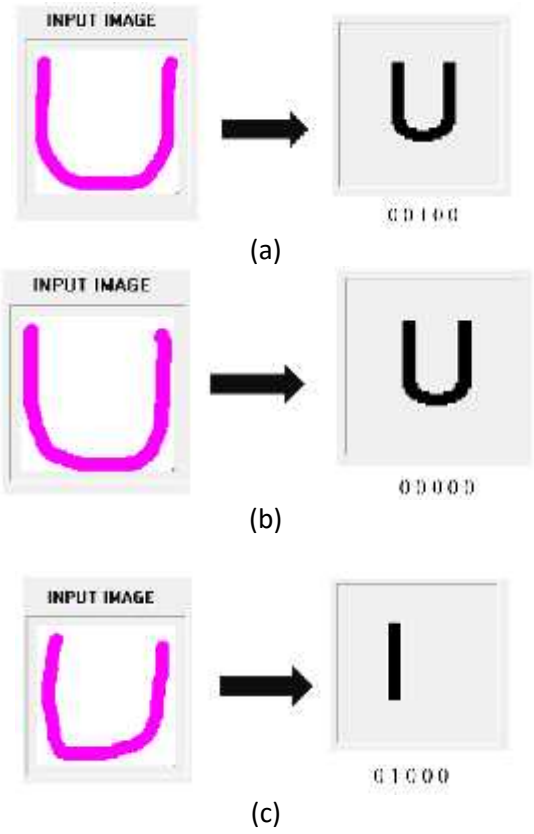


**Figure 3.** Testing result (a) 'U' letter known writing, (b) 'U' letter unknown writing, (c) 'U' letter writing known as 'I'

**Table 3.** testing result of 10 samples for each character

| Character | Result (%) |
|---|---|
| A | 100 |
| I | 80 |
| U | 80 |
| E | 80 |
| 0 | 80 |
| Average | 84 |

## 5 Conclusion

Based on the test result, the system succeeded in recognizing writing with total of 84% success level in which every character had 1 recognizing mistake from 5 tests total with 10 samples for each character. If the total of sampling was more, the success level would be higher.

## References

[1] Menteri Kesehatan Republik Indonesia. Peraturan Menteri Kesehatan Republik Indonesia Nomor. 269/MENKES/PER/III/2008.

[2] Sokol DK, Hettige S. 2006. Poor handwriting remains a significant problem in medicine. Journal of The Royal SocietyOf Medicine. Pp. 645-646

[3] Ni Luh Ratniasih. 2016. Analisa Dan Perancangan Sistem Rekam Medis Elektronik Pada Rs. Premagana. Seminar Nasional Teknologi Informasi dan Multimedia. Pp. 91 - 96.

[4] Gunawan Susanto, Sukadi, 2012. Sistem Informasi Rekam Medis Pada Rumah Sakit Umum Daerah (RSUD) Pacitan Berbasis Web-Base, *(IJCSS) 14 - Indonesian Jurnal on Computer Science Speed - FTI UNSA Vol 9 No 3*

[5] *Wimmie Handiwidjojo. 2009. Rekam Medis Elektronik. Vol. 2. No. 1. Pp. 32 – 38*

[6] *Haykin, S., "Neural networks: a comprehensive fundation", PRENTICE HALL, NEW JERSEY, 1999.*

[7] *Gurney,K., "Neural Nets by Kevin Gurney", <URL: http://www.shef.ac.uk/ psychology/gurney/notes/index.html>, 1999.*

[8] Dipalee Gupta, Siddhartha Choubey. 2015. Discrete Wavelet Transform for Image Processing. International Journal of Emerging Technology and Advanced Engineering. Vol. 4, Issue. 3. Pp. 598 – 602

[9] Fachrudin Pakaja, Agus Naba dan Purwanto. 2012. Peramalan Penjualan Mobil Menggunakan Jaringan Syaraf Tiruan dan *Certainty Factor*. Jurnal EECCIS Vol. 6, No